

**Title**

A Mixed Methods Process Evaluation of a Print-based Intervention Supported by Internet Tools to Improve Physical Activity in UK Cancer Survivors.

**Authors**

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**Abstract**

**Objective:** A waiting list randomised control trial has shown the Move More Pack, a print-based intervention supported by Internet tools, to improve physical activity levels in cancer survivors; however, one-third do not improve from the intervention. The objective of this process evaluation is to understand intervention use, the mechanisms of impact, the perceived benefits, and the contextual factors influencing these, identifying for whom it is a useful resource.

**Methods:** A mixed methods process evaluation, based on guidance from the UK Medical Research Council, including 181 questionnaire responses on intervention use and physical activity improvement over 12-weeks, 56 open text responses and 17 semi-structured interviews.

**Results:** The Move More Pack was suggested to be most useful when delivered towards the start of the cancer journey to those with a positive attitude to fighting cancer but with a low level of physical activity, capitalising on a teachable moment. It was suggested that healthcare professionals could support the effective distribution of the Move More Pack. The intervention's printed components were more popular and well used than the Internet tools. The printed intervention components were positively correlated with physical activity

improvement but the Internet tools were not. Females were more likely to use the intervention's printed components than males. Cancer survivors using the intervention reflected that they had increased confidence and motivation for physical activity and other lifestyle behaviours.

Conclusion: The Move More Pack should be offered by healthcare professionals, during cancer treatment, when health is salient, to those with a positive attitude to fighting cancer but with low levels of physical activity. Use of the intervention's printed components are more likely to improve physical activity than the Internet tools and are more likely to be used by females. The use of Internet tools to support physical activity improvement in cancer survivors requires further investigation.

## Main text

### Introduction

The benefits of physical activity for cancer survivors are well documented;<sup>1</sup> however, most cancer survivors are inactive.<sup>2</sup> Physical activity decreases following a diagnosis of cancer and may not increase without intervention.<sup>3</sup> A scarcity of cancer-specific physical activity support services and the growing number of cancer survivors highlights the need for evidence-based remote interventions.<sup>4</sup> One such intervention available to UK adult cancer survivors is the Move More Pack, a low-cost multicomponent intervention, including a series of printed resources, Internet tools and e-newsletters.

The Move More Pack was developed using the Social Cognitive Theory,<sup>5</sup> the Theory of Planned Behaviour,<sup>6</sup> and the Physical Activity Stage of Change Model,<sup>7</sup> with Behaviour Change Techniques (BCTs) selected from the Behaviour Change Technique Taxonomy version 1.<sup>8</sup> The components of the Move More Pack and the e-newsletters, the theoretical constructs that each intervention component aims to influence, and the included BCTs are reported elsewhere.<sup>9</sup>

A recent waiting list randomised control trial (RCT) found the Move More Pack to significantly improve physical activity in adult cancer survivors over 12-weeks.<sup>9</sup> However, the intervention did not work for all participants with one third of cancer survivors not improving their physical activity, justifying the need for this process evaluation.

The UK Medical Research Council (MRC)<sup>10,11</sup> highlight the importance of process evaluations to assess an intervention's mechanisms of impact (or active ingredients),<sup>8</sup> the perceived benefits, and the contextual factors influencing use, helping to identify those likely to find an intervention useful. Process evaluations support effective intervention distribution and development, an area that is lacking in the extant literature.<sup>12-15</sup>

This process evaluation aims to answer the following questions:-

1. Does age, gender, tumour site or cancer status influence use of the Move More Pack?
2. What are the contextual factors influencing the use and usefulness of the Move More Pack?
3. What are the Move More Pack's mechanisms of impact?
4. What are the perceived benefits from use of the Move More Pack?

## Method

### Design:

This process evaluation used mixed methods and was embedded within a waiting list RCT assessing the effectiveness of the Move More Pack at improving physical activity, self-efficacy and health-related quality of life. The study protocol for this process evaluation has been reported elsewhere<sup>16</sup> as have the results of the waiting list RCT.<sup>9</sup>

### Participants and intervention:

The waiting list RCT in which this process evaluation was embedded included 207 participants, 104 in the intervention arm and 103 in the waiting list control arm. Participants were aged 18-years or over, with mixed tumour sites, cancer stages, and levels of physical activity. As a waiting list RCT, all participants eventually received the Move More Pack, distributed in the mail. The intervention was delivered as outlined in the study protocol, reported elsewhere.<sup>16</sup>

### Quantitative data collection and analysis:

To assess interaction with the Move More Pack all waiting list RCT participants were asked to complete an online questionnaire, administered 12-weeks after the introduction of the Move More Pack, on their use of each intervention component, assessed using a 4-point

Likert scale of often, sometimes, rarely, and never. In addition, participants were asked to indicate on a 7-point Likert scale their agreement with the statement *The e-newsletters were helpful in getting me more active.*<sup>16</sup>

Physical activity data was collected using the Godin Leisure-Time Exercise Questionnaire (GLTEQ). The GLTEQ produces a physical activity score calculated from the frequency of mild, moderate and strenuous activities completed in the previous week.<sup>17,18</sup> Baseline physical activity was taken at the point of intervention delivery with follow-up 12 weeks later. Twenty-six participants were lost during follow up in the waiting list RCT with 181 participants completing the questionnaire on use of the intervention as-well-as providing physical activity data. Quantitative analysis was completed on these 181 participants (the participant characteristics are available in supplementary file 1).

The questionnaire Likert scale responses pertaining to intervention use were converted to numerical values with composite scores calculated for use of the intervention's print and Internet components. Use of the printed components, Internet tools, and usefulness of the e-newsletters were each assessed for their association with physical activity improvement using Pearson's correlation coefficient. The participant demographics of age and gender were each assessed for their relationship with intervention use using simple linear regression. Tumour site and cancer status were each assessed for their relationship with intervention use using a one-way analysis of variance (ANOVA). All statistical test assumptions were met.

#### Qualitative data collection and analysis:

Fifty-six participants provided an open text questionnaire response on their use and usefulness of the intervention. Seventeen participants took part in a semi-structured telephone interview. Recruitment details and the interview topic guide are reported elsewhere.<sup>16</sup> The characteristics of the interviewed participants are available in Table 1. All interviews were conducted by JW, 13 or 14 weeks after receipt of the intervention. The interviews lasted between 19 and 55-minutes with an average duration of 35-minutes. A formal thematic analysis<sup>19</sup> was conducted on the qualitative data details of which are reported elsewhere.<sup>16</sup> JW and JS initially reviewed and coded five randomly selected interview transcripts. The coding was compared with differences discussed. JW then coded all remaining transcripts.

*Insert Table 1*

## Results

### Intervention use and physical activity improvement:

The ranking of use for each component of the Move More Pack is presented in Table 2. The usefulness of the e-newsletters is presented in Table 3. The composite score for use of the printed intervention components was positively correlated with physical activity improvement ( $R = .182$ ,  $n = 181$ ,  $p = .014$ ). However, the composite score for use of the Internet tools was not correlated with physical activity improvement, nor was the perceived usefulness of the e-newsletters (data not shown).

Regression analysis showed that females were more likely to make use of the printed intervention components ( $R^2 = .18$ ,  $F(1,179) = 6.14$ ,  $p = .014$ ) and perceive the e-newsletters as useful ( $R^2 = .17$ ,  $F(1,179) = 5.44$ ,  $p = .021$ ) but gender did not predict use of the Internet tools. Age was not associated with intervention use, neither the printed components, the Internet tools or the perceived usefulness of the e-newsletters. An ANOVA found no relationship between tumour site or cancer status and intervention use, neither the printed components, the Internet tools, or the perceived usefulness of the e-newsletters (data not shown).

### *Insert Tables 2 and 3*

### Thematic analysis:

The thematical analysis identified four themes. A narrative of each of these themes is provided. To bring the qualitative extracts to life pseudonyms are provided for the interviewed participants. Excerpts from the questionnaire open text responses are given with the age, gender, cancer type and cancer status of the respondent. The mechanisms of impact, perceived benefits and contextual factors for each theme are presented in Figures 1 to 4.

#### Theme 1 - Capitalising on a teachable moment:

Most respondents commented on the adverse physical and mental consequences of cancer and it's treatment. These impacts, for some, raised the salience of health, creating a teachable moment when coupled with a positive attitude to fighting cancer. Becky said: "You might want something like that [the Move More Pack] to almost help you feel that you are

physically fighting it in some way.” Treatment was seen as a suitable time for intervention delivery. Even if cancer survivors felt unable to become active at this time, receiving the intervention prompted an intention to become active when the consequences of cancer treatment were less severe.

Because you’ve got more time I think to absorb information then...during treatment when you’re having chemotherapy you can’t really do any exercise, or not much, but you’re thinking to the future when you might start doing it. (Danielle)

Respondents spoke of the impacts of treatment accumulating over time, and how if they had their time again, they would have become more active earlier, emphasising the importance of giving the Move More Pack early in the cancer journey. Whilst not as common, the Move More Pack may capitalise on teachable moments that occur later in the cancer journey, continuing to help recovery both physically and mentally. For example, a 61-year-old male in remission from non-Hodgkin’s lymphoma said: “Having cancer can make you become isolated and the Pack was an encouragement to look further than your front door”. A view supported by Serena, who said: “I don’t know it just came at the right time, I think I was feeling a bit low and depressed and I felt overweight, sluggish and I think I just needed to read that sort of thing.”

When delivered during a teachable moment the Move More Pack increased motivation and confidence in respondents and their families, increasing physical activity as-well-as positively impacting upon other lifestyle behaviours.

It gave me the motivation and confidence to move more and get fitter. The knock-on effect has been a huge improvement in my routine and eating habits ... but not just my own habits! My husband was coerced into joining me in this quest, we are both feeling fitter and healthier  
(Questionnaire respondent, a 61-year-old female in remission from Breast cancer)

The Move More Pack helped redefine physical activity from exercise for exercise sake to incorporating physical activity into daily life, with Penny saying: I think that’s a really good message, sort of incorporating it into your everyday life so it’s not another thing you’ve got to find time for.”

It was suggested that if physical activity advice was provided from a healthcare professional, in combination with the Move More Pack, it could enhance its use and impact; Ellen said:

You really need somebody to say, put it in your hand and make you read it....Talking about exercise is a lot like a lesser thing really. But looking back now, I wish they [the healthcare team] had of done because I'd have probably took more note of it then and done something about it.  
(Ellen)

The printed components were popular, tangible and easily accessible; however, whilst the printed components were “really useful”, they were also seen as “quite a lot of information” and “quite daunting”(Katherine). Respondents used “a combination” (Ellen) of the printed components, particularly the Guide to Becoming Active and the Pull-out Wall Chart, useful for recording and prompting physical activity. A 54-year-old female in treatment for Breast cancer, said: “I found the Wall Chart hugely beneficial. It really motivated me to see my progress at a glance. I still use it - it is a visible reminder on the side of my fridge and a source of encouragement.” Information on simple ways to become more active was highlighted as useful, supporting action planning and goal setting. The DVD was also suggested to be as a good starting point for physical activity.

[The Move More Pack] gave me ideas about different activities I could participate in and where and how to access them. It is a good reminder...and you can keep a record of personal activity. I like the goal-setting and the tips. (Questionnaire respondent, a 54-year-old female in remission from cancer of the Uterus)

Well the DVD, I felt very beneficial [it] goes through all the different exercises which I think is good for somebody who's going, perhaps just had surgery or going through chemotherapy where their levels of activity aren't quite so high, they're gentle and it's just a build-up and I think that's very good. It certainly helped me anyway. (Carmen)

The Internet tools were less popular; a 54-year-old female in treatment for Breast cancer, said: “I spend so much of my working life online, I elected not to track my health in that way.” The views on the e-newsletters were mixed; some respondents did not even acknowledge them whilst others found them useful prompting use of the printed intervention components.

*Insert Figure 1*

## Theme 2 - Already moving:

Some respondents had already decided to become physically active as a result of their cancer diagnosis, to fight back. Again, respondents had felt the harsh consequences of cancer and its treatments, but they had also felt the benefits of physical activity in improving them including fatigue, physical function, mental well-being and weight gain.

When I was going through my chemo I tried to keep as active as possible and I could see even that was helping me. And then the radiotherapy, because people said, oh it makes you so, so tired, and yes it did but if you can push through that tiredness it makes you feel so much better. (Linda)

Some respondents had already found the support tools they needed to become and stay active. These cancer survivors felt that the Move More Pack was not for them; however, many still found elements of the intervention useful, in particular, the monitoring tools such as the Pull-out Wall Chart and the Activity Diary (included in the Guide to Becoming Active).

Respondents spoke of the Move More Pack raising the importance of physical activity in relation to cancer, reinforcing their decision to become active. Lucy said: “It was basically saying that it can reduce recurrence. So, I was just like, right that just shows how important it is...That just really stuck in my mind.” In addition, respondents stated that the Move More Pack permitted them to be active, particularly when faced with advice to rest.

I thought it was really good that it had bits that you could fill in and activity charts and things that you could involve the family in as well. I tried to get them to come on a run with me....My husband said to me, oh should you be doing that and it's quite handy to say to him, yes look, this is what the advice [says], because he's concerned about what I'm doing. (Zara)

## *Insert Figure 2*

## Theme 3 - I am highly active:

Some respondents already considered themselves as highly active, having always been active. There was a strong belief that they were doing enough physical activity or knew what they needed to do when they felt able, not requiring additional support. Consequently, the Move More Pack was given a cursory glance and then disregarded.

I knew what I could do and what I wanted to do and what I had been doing and that's where I wanted to get back to and I didn't really need the additional support to do that. I had



the...resources and I knew where to find them and what fitted in around my lifestyle already.  
(Becky)

Respondents were motivated by a desire to get back to normal, rather than by cancer, as “fitness” was part of their self-identity; Becky said: “the diagnosis didn’t motivate me it was to... try and get back to that fitness level because I think I was slightly frustrated”.

Some respondents felt using the intervention would be tantamount to slowing down; John said: “I’ve read through all [the] information...and I was quite surprised as to how little some people are moving or are motivated to move about.”

### *Insert Figure 3*

#### Theme 4 - Physical activity is not for everybody:

Some respondents were experiencing particularly harsh consequences of treatment, in many cases linked to a recurrence of cancer, putting physical activity out of mind. These cancer survivors had to focus on managing their energy to get through their day, with no energy to be physically active.

Since the cancer has come back I’m not at my best as I am having chemo every week now and have to have my stomach drained every few weeks which involves a hospital stay, so I can’t be active...just getting through the day is enough for now. (Questionnaire respondent, 63-year-old female in treatment for Peritoneal cancer)

Physical limitations were exacerbated for some by other long-term conditions, for example, a 67-year-old male in remission from Bowel cancer said: “My health is not good...I have been diagnosed with Polymyalgia which makes me tired and in constant pain. My involvement in any exercise is practically nil”.

Some respondents stated that they lacked motivation, were experiencing low mood, and that dealing with cancer was enough with no room for anything else. Being inactive before diagnosis exacerbated the barriers to becoming active. A 53-year-old female in remission from cancer of the Uterus said: “I was inactive before cancer and now cancer adds a feeling of low mood so that doesn't motivate you. It takes all your energy to keep going day to day.”

#### *Insert Figure 4*

### Discussion

This process evaluation aimed to understand if age, gender, cancer status or tumour site influences use of a printed-based intervention supported by Internet tools to improve physical activity in UK cancer survivors. In addition, this process evaluation investigated the contextual factors influencing intervention use, the mechanisms of impact, and the perceived intervention benefits, identifying for whom the Move More Pack is a useful resource.

Understanding the use and usefulness of the Move More Pack:

Intervention use and usefulness are different concepts. The quantitative data analysis suggests that intervention use is not associated with age, tumour site or cancer status supporting the extant literature.<sup>20</sup> However, females maybe more likely than males to use the intervention's printed components and find the e-newsletters useful. The qualitative data develops an understanding of the contextual factors that may influence the usefulness of the intervention,

The qualitative analysis suggests that the cancer survivors most likely to find the intervention useful are those in the early stages of their cancer journey with a positive attitude to fighting cancer and who have yet to decide to become physically active. It has been suggested that low-intensity self-directed interventions delivered at a teachable moment may be enough to bring about change.<sup>21, 22</sup> Cancer survivors already active, or who are preparing to be active, as a result of their cancer reflect that they do not see the Move More Pack as relevant but they may still find the included monitoring tools useful.

Some cancer survivors identify as highly active individuals, having always been active, even if they are not currently as active as they would like. These cancer survivors are unlikely to want additional support related to physical activity and are likely to only give the Move More Pack a cursory glance before disregarding it. Some cancer survivors experience particularly harsh consequences of cancer treatment exacerbated by cancer recurrence, other long-term conditions, and poor mental wellbeing, a finding in support of systematic review evidence from Clifford et al. on the barriers to physical activity.<sup>23</sup> The Move More Pack is unlikely to influence physical activity in these cancer survivors; more intense support is likely to be necessary.

Previous literature suggests that cancer survivors and their closest supporters want lifestyle advice from healthcare professionals<sup>24,25</sup> including a package of support materials,<sup>26</sup> findings supported by this process evaluation. It is possible that healthcare professionals could support the identification of those most likely to find the Move More Pack useful supporting its effective distribution.

#### Mechanisms of impact:

Researchers have called for a better understanding of what BCTs bring about change.<sup>12,15</sup> Use of the printed intervention components is shown to be associated with physical activity improvement. Information about the health and emotional consequences of being physically active, provision of a social comparison, use of prompts, rewards, goal-setting and the self-monitoring of physical activity, are BCTs shown in systematic review evidence to improve physical activity in cancer survivors.<sup>15,27</sup> These BCTs are included in the printed intervention components and are identified in the qualitative accounts. Other BCTs identified in the qualitative accounts include making a commitment through action planning, promotion of physical activity opportunities, the reframing of physical activity, engaging families, and the DVD providing instruction, demonstration, and graded activities.

The extant literature suggests that 39% of cancer survivors would like to receive physical activity support over the Internet,<sup>28</sup> with calls made for the greater use of Internet tools.<sup>29,30</sup> The findings from this process evaluation suggest that printed intervention components have greater use and are more useful and tangible to cancer survivors than Internet tools. These findings are in support of Golsteijn et al.<sup>30</sup> who conclude that cancer survivors are more likely to engage with print-based interventions. The use of Internet tools to support physical activity improvement in cancer survivors requires further investigation.

The e-newsletters are well received by some cancer survivors with 38.2% at least somewhat agreeing that they were helpful in supporting improvements in physical activity. Use of tailored e-newsletters to improve physical activity in cancer survivors is supported by Short et al.<sup>31,32</sup> However, 20.9% disagree with the usefulness of the e-newsletters which may be explained by the identified qualitative themes, with those who consider themselves as highly active, or not able to be physically active, not finding the e-newsletters useful.

#### Perceived benefits:

The qualitative data suggests increased motivation and confidence for physical activity from using the Move More Pack. This supports the findings of the waiting list RCT which reports a positive trend in self-efficacy from the intervention.<sup>9</sup> Participants also reflect on the positive influence of the intervention on other lifestyle behaviours and the behaviour of family members. Cancer survivors who have already made the decision to become physically active as a result of their cancer say that the intervention supports this decision as well as influencing the attitudes of family members.

#### Strengths and limitations:

The limitations associated with phone interviews and the possible biases resulting from the interviews being conducted by JW as the primary contact for participants are acknowledged. Use of a self-reported measure of physical activity is acknowledged as a weakness of this study; however, use of an objective measure would have introduced an additional BCT not included within the intervention.

A strength of this process evaluation is the gathering of data from participants across tumour sites and cancer stages from multiple sources including 17 in-depth interviews, 56 open-text comments, and 181 questionnaire responses, a broad dataset upon which to draw conclusions. It is, however, acknowledged that use of the Move More Pack and the physical activity scores for the 26-waiting list RCT participants lost at follow-up are not known and may have introduced an attrition bias.

#### Conclusion:

Previous research has shown the Move More Pack, a print-based intervention supported by Internet tools, to be effective at improving physical activity in cancer survivors,<sup>9</sup> however, it does not improve physical activity for all. This process evaluation suggests that the Move More Pack, in particular the printed components, may be most useful if delivered early in the cancer journey, possibly during treatment when health is salient, to those who have a positive attitude to fighting cancer with low levels of physical activity. Females may be more receptive to the intervention than males. Healthcare professionals may be able to support intervention distribution helping to identify those most likely to find the intervention useful. Intervention use is not associated with age, tumour site or cancer status. Cancer survivors who are inactive and experiencing particularly harsh consequences of treatment are likely to need additional support to become physically active.

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#### Competing interests:

JW and JS are former members of staff of Macmillan Cancer Support. No other conflicts of interest are reported.

#### Ethical approval:

Ethical approval was received from the University of Surrey (reference: UEC/2017/023/FHMS).

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